

**El Niño and La Niña events simulated by the Cane and Zebiak's model  
and observed with satellite or *in situ* data**

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The Zebiak and Cane (1987) model is first run in its “forced mode”, e.g. the oceanic part of the model is driven by FSU wind stress anomalies over 1980-1994 to simulate sea surface temperature anomalies and those are used in the atmospheric part of the model to generate wind anomalies. Simulated **thermocline** depths, sea surface temperature and wind stress anomalies are frost validated with observations. Variations of **thermocline** depth agree reasonably well with sea level derived from Geosat or with the heat content *in the* upper 400m derived from XBT. The model simulates **zonal** current oscillations which are dominated by the resonant mode of the basin at a 9 month frequency. The **zonal** current anomalies derived from projecting **altimetric** data on Kelvin and Rossby waves reverse from eastward during El Niño to westward during La Niña events. The model is successful in reproducing the warm anomalies during El Niño events, but it fails to simulate the cold anomalies which are observed in AVHRR data as well as in XBT data. The model is also successful to reproduce the observed westerlies during El Niño events, but it fails to simulate the easterlies during La Niña 1988.

When forced with observed SST, the atmospheric model simulates wind anomalies in much better agreement with observed winds. The simulated winds are however offset to the East. This is because the simulated forcing term is located too close to the SST anomalies **whereas** the observed cloud convection indicates that the forcing term is mostly located in the *central* and western Pacific. The atmospheric model needs to be forced by a combination of SST and cloud convection data in order to simulate the wind anomalies at the comet location.

The major deficiency of the ocean-atmosphere model comes indeed from the oceanic part of the model. The model data misfit **can** be reduced by adding the net flux due to latent heat and solar radiation in the SST equation. The net flux tends to warm the ocean during El Niño events because the trade winds are weaker then and there is less evaporation than usual. The air-sea fluxes added in the model thus have a positive feedback on the sea surface temperature. They increase the strength and the duration of the anomalies closer to the observed ones.

But the model can **recover** the cold anomalies and the easterlies in the central Pacific during La Niña events only if the parametrization of **entrainment** temperature is revisited towards an enhanced role of **thermocline upwellings**. A new parametrization of this entrainment is derived from the XBT temperature profiles. The model run with this new parametrization in the “forced mode” simulates **thermocline**, SST and wind anomalies in very good agreement with observations over 1980-1994.

The model is then run in a “coupled mode”. When the new parametrization of entrainment temperature is introduced, the sea surface temperature no longer oscillates at a frequency close to 4 years, but close to 2 years. The role of off-equatorial processes is also examined because observations show that the El-Niño in 1992-1993 was **preceded** by a **thermocline** anomaly propagating from the north Pacific to the equator whereas the anomalies simulated by the coupled model **systematically** propagate away from the equator in the northern and southern Pacific.